

## SECTION 1056 GEOSYNTHETICS

### 1056-1 DESCRIPTION

Provide geosynthetics for subsurface drainage, separation, stabilization, reinforcement, erosion control, filtration and other applications in accordance with the contract. Use geotextiles, geocomposite drains and geocells that are on the NCDOT APL. Prefabricated geocomposite drains include sheet, strip and vertical drains (PVDs), i.e., “wick drains” consisting of a geotextile attached to and/or encapsulating a plastic drainage core. Geocells are comprised of ultrasonically welded polymer strips that when expanded form a 3D honeycomb grid that is typically filled with material to support vegetation. Define geotextiles, geogrids, geocomposite drains and geocells as geosynthetics.

If necessary or required, hold geotextiles, geogrids and sheet drains in place with new wire staples, i.e., “sod staples” that meet Subarticle 1060-8(D) or new anchor pins. Use steel anchor pins with a diameter of at least 3/16 inch and a length of at least 18 inches and with a point at one end and a head at the other end that will retain a steel washer with an outside diameter of at least 1.5 inches.

### 1056-2 HANDLING AND STORING

Load, transport, unload and store geosynthetics so geosynthetics are kept clean and free of damage. Label, ship and store geosynthetics in accordance with Section 7 of AASHTO M 288. Geosynthetics with defects, flaws, deterioration or damage will be rejected. Do not unwrap geosynthetics until just before installation. Do not leave geosynthetics exposed for more than 7 days before covering except for geotextiles for temporary wall faces and erosion control.

### 1056-3 CERTIFICATIONS AND IDENTIFICATION

Provide Type 1, Type 2 or Type 4 material certifications in accordance with Article 106-3 for geosynthetics except certifications are not required for Type 1 through Type 4 geotextiles marked with the product name. Define “machine direction” (MD), “cross-machine direction” (CD) and “minimum average roll value” (MARV) in accordance with ASTM D4439. Provide certifications with MARV for geosynthetic properties as required. Test geosynthetics using laboratories accredited by the Geosynthetic Accreditation Institute (GAI) to perform the required test methods. Sample geosynthetics in accordance with ASTM D4354.

Geotextiles will be identified by the product name printed directly on the geotextile by the Manufacturer. For all other geosynthetics and when geotextiles are not marked with a product name, geosynthetics will be identified by the product label attached to the original packaging or the geosynthetic itself by the Manufacturer.

Allow the Engineer to visually verify geosynthetic products before installation. Open packaged geosynthetics just before use in the presence of the Engineer to confirm the correct product. Geotextile rolls without the product name printed on the geotextile or the product label affixed to the geotextile or roll core by the Manufacturer will be rejected. Any other geosynthetics that are unwrapped, missing original packaging or previously opened may not be used unless approved by the Engineer.

### 1056-4 GEOTEXTILES

When required, sew geotextiles together in accordance with Article X1.1.4 of AASHTO M 288. Provide sewn seams with seam strengths meeting the required strengths for the geotextile type and class specified.

Provide geotextile types and classes in accordance with the contract.

Use woven or nonwoven geotextiles with properties that meet Table 1056-1.

**Section 1056**

**TABLE 1056-1  
GEOTEXTILE REQUIREMENTS**

Property <sup>A</sup>	Requirement (MARV <sup>A</sup> )					Test Method
	Type 1	Type 2	Type 3 <sup>B</sup>	Type 4	Type 5 <sup>C</sup>	
<i>Typical Application</i>	<i>Shoulder Drains</i>	<i>Under Rip Rap</i>	<i>Silt Fence Fabric</i>	<i>Soil Stabilization</i>	<i>Temporary Walls</i>	
Elongation (MD & CD)	≥ 50%	≥ 50%	≤ 25%	< 50%	< 50%	ASTM D4632
Grab Strength (MD & CD)			100 lb <sup>A</sup>			ASTM D4632
Tear Strength (MD & CD)	Table 1 <sup>D</sup> , Class 3	Table 1 <sup>D</sup> , Class 1	-	Table 1 <sup>D</sup> , Class 3	-	ASTM D4533
Puncture Strength			-			ASTM D6241
Ultimate Tensile Strength (MD & CD)	-	-	-	-	2,400 lb/ft <sup>A</sup> (unless required otherwise in the contract)	ASTM D4595
Permittivity	Table 2 <sup>D</sup> , 15% to 50% <i>in Situ</i> Soil Passing 0.075 mm	Table 6 <sup>D</sup> , 15% to 50% <i>in Situ</i> Soil Passing 0.075mm	Table 7 <sup>D</sup>	Table 5 <sup>D</sup>	0.20 sec <sup>-1.A</sup>	ASTM D4491
Apparent Opening Size					0.60 mm <sup>E</sup>	ASTM D4751
UV Stability (Retained Strength)					70% <sup>A</sup> (after 500 hr of exposure)	ASTM D4355

- 1     **A.** MD, CD and MARV per Article 1056-3.
- 2     **B.** Minimum roll width of 36 inches required.
- 3     **C.** Minimum roll width of 13 feet required.
- 4     **D.** AASHTO M 288
- 5     **E.** Maximum average roll value.

**1056-5 GEOCOMPOSITE DRAINS**

7 Provide geocomposite drain types in accordance with the contract and with properties that  
8 meet Table 1056-2.

**TABLE 1056-2  
GEOCOMPOSITE DRAIN REQUIREMENTS**

Property	Requirement			Test Method
	Sheet Drain	Strip Drain	Wick Drain	
Width	≥ 12" (unless required otherwise in the contract)	12" ±1/4"	4" ±1/4"	N/A
In-Plane Flow Rate <sup>A</sup> (with gradient of 1.0 and 24-hour seating period)	6 gpm/ft @ applied normal compressive stress of 10 psi	15 gpm/ft @ applied normal compressive stress of 7.26 psi	1.5 gpm <sup>B</sup> @ applied normal compressive stress of 1.45 psi	ASTM D4716

- 9     **A.** MARV does not apply to thickness
- 10    **B.** Per foot of width tested

11 For sheet and strip drains, use accessories (e.g., pipe outlets, connectors, fittings, etc.)  
12 recommended by the Drain Manufacturer. Provide sheet and strip drains with Type 1  
10-78

- 1 geotextiles heat bonded or glued to HDPE, polypropylene or high impact polystyrene  
2 drainage cores that meet Table 1056-3.

<b>TABLE 1056-3</b>			
<b>DRAINAGE CORE REQUIREMENTS</b>			
<b>Property</b>	<b>Requirement (MARV)</b>		<b>Test Method</b>
	<b>Sheet Drain</b>	<b>Strip Drain</b>	
Thickness	1/4"	1"	ASTM D1777 or D5199
Compressive Strength	40 psi	30 psi	ASTM D6364

- 3 For wick drains with a geotextile wrapped around a corrugated drainage core and seamed to  
4 itself, use drainage cores with an ultimate tensile strength of at least 225 lbs. per 4 inch width  
5 in accordance with ASTM D4595 and geotextiles with properties that meet Table 1056-4.

<b>TABLE 1056-4</b>		
<b>WICK DRAIN GEOTEXTILE REQUIREMENTS</b>		
<b>Property</b>	<b>Requirement</b>	<b>Test Method</b>
Elongation	≥ 50%	ASTM D4632
Grab Strength	Table 1 <sup>A</sup> ,	ASTM D4632
Tear Strength		ASTM D4533
Puncture Strength	Class 3	ASTM D6241
Permittivity	0.7 sec <sup>-1</sup> . <sup>B</sup>	ASTM D4491
Apparent Opening Size (AOS)	Table 2 <sup>A</sup> ,	ASTM D4751
UV Stability (Retained Strength)	> 50% <i>in Situ</i> Soil Passing 0.075 mm	ASTM D4355

- 6 **A.** AASHTO M 288.  
7 **B.** MARV per Article 1056-3

- 8 For wick drains with a geotextile fused to both faces of a corrugated drainage core along the  
9 peaks of the corrugations, use wick drains with an ultimate tensile strength of at least 1,650  
10 lbs/ft in accordance with ASTM D4595 and geotextiles with a permittivity, AOS and UV  
11 stability that meet Table 1056-4.

## 12 **1056-6 GEOCELLS**

- 13 Manufacture geocells from virgin polyethylene resin with no more than 10% rework, also  
14 called "regrind", materials. Use geocells made from textured and perforated HDPE strips  
15 with an open area of 10% to 20% and properties that meet Table 1056-5.

## Section 1060

**TABLE 1056-5  
GEOCELL REQUIREMENTS**

Property	Minimum Requirement	Test Method
Cell Depth	4"	N/A
Sheet Thickness	50 mil -5%, +10%	ASTM D5199
Density	58.4 lb/cf	ASTM D1505
Carbon Black Content	1.5%	ASTM D1603 or D4218
ESCR <sup>A</sup>	5000 hr	ASTM D1693
Coefficient of Direct Sliding (with material that meets AASHTO M 145 for soil classification A-2)	0.85	ASTM D5321
Short-Term Seam (Peel) Strength (for 4" seam)	320 lb	USACE <sup>C</sup> Technical Report GL-86-19, Appendix A
Long-Term Seam (Hang) Strength <sup>B</sup> (for 4" seam)	160 lb	

1        **A.** Environmental Stress Crack Resistance.

2        **B.** Minimum test period of 168 hours with a temperature change from 74°F to 130°F in  
3        1-hour cycles.

4        **C.** US Army Corps of Engineers

5        Provide geocell accessories (e.g., stakes, pins, clips, staples, rings, tendons, anchors,  
6        deadmen, etc.) recommended by the Geocell Manufacturer.

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## SECTION 1060

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### LANDSCAPE DEVELOPMENT MATERIALS

#### 10    **1060-1 GENERAL**

11    Supply certifications for all landscape development materials as required below. If no  
12    certification is required, supply the Department with a statement certifying that all materials  
13    conform to these Specifications and those of the NC Department of Agriculture and  
14    Consumer Services (NCDA&CS) or both. All landscape development materials shall comply  
15    with all applicable Federal and State domestic plant quarantines.

#### 16    **1060-2 FERTILIZER**

17    The quality of all fertilizer and all operations in connection with the furnishing of this material  
18    shall comply with the North Carolina Fertilizer Law and with the rules and regulations,  
19    adopted by the North Carolina Board of Agriculture in accordance with said law, in effect at  
20    the time of sampling. All fertilizer will be subject to sampling and testing by the Engineer, or  
21    by an authorized representative of the North Carolina Department of Agriculture and  
22    Consumer Services, or both.

23    Dry fertilizer shall be manufactured from cured stock. Care for the fertilizer during handling  
24    and storing in such a manner that it will be protected against hardening, caking or loss of plant  
25    food values. Pulverize any hardened or caked fertilizer to its original condition before using.

#### 26    **1060-3 LIMESTONE**

27    The quality of all limestone and all operations in connection with the furnishing of this  
28    material shall comply with the North Carolina Agricultural Liming Materials and Landplaster  
29    Act, and with the rules and regulations, adopted by the North Carolina Board of Agriculture  
30    and Consumer Services in accordance with said law, in effect at the time of sampling. All